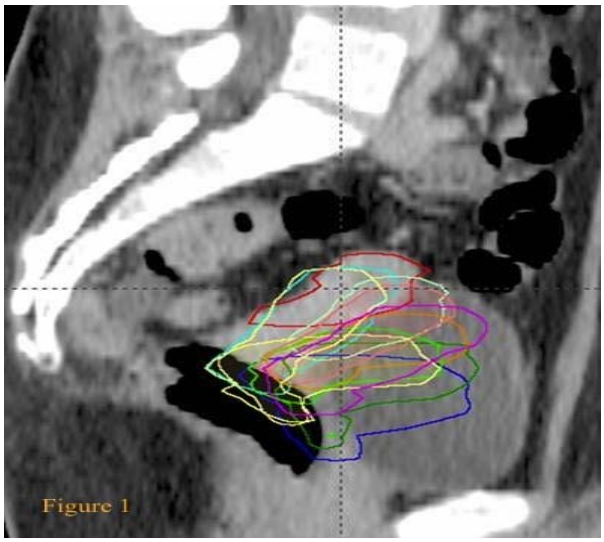

Electronic Poster: Physics track: Imaging: focus on clinical applications

EP-1516

Cherenkov imaging of IMRT/VMAT plans with high temporal and spatial resolution

B. Pogue[1], A.K. Glaser[1], R. Zhang[1], J.M. Andreozzi[1], L.A. Jarvis[2], D.J. Gladstone[2]
[1]*Dartmouth College, Engineering / Surgery, Hanover, USA*
[2]*Geisel School of Medicine, Radiation Oncology, Hanover, USA*

Purpose/Objective: Cherenkov emission from water tank is possible at 20 frames per second acquisition, and so this allows direct high resolution visualization of the delivery of IMRT and VMAT plans for the first time ever. This study focuses on the temporal and spatial capabilities of the first 2+D, and 3D Cherenkov water imaging systems.
Materials and Methods: Cherenkov emission was imaged from a standard water tank, with 1g/L quinine sulphate in solution. The emission was detected using a time-gated ICCD camera synchronized to the LINAC pulses at 200Hz. Images were collected at 20Hz with room lights on, using background acquisition and subtraction. 2+D imaging of TG-119 plans was done with imaging treatments from one perspective. 3D imaging was done for a static beam by rotating the water tank and camera through 360 degrees during imaging.
Results: 2+D imaging of delivery can be achieved with extremely high resolution (300 microns) using the appropriate lens and ICCD, and the ability to capture the volumetric temporal kinetics of delivery is unique to this type of imaging system. The agreement between Cerenkov image and dose map from the treatment planning system was greater than 96% from gamma analysis using a 3%/3mm criteria. 3D imaging of individual beams illustrates how high resolution features of the MLC can be captured, and even leakage radiation through the closed MLCs and the end leakage can be visualized with high SNR.
Conclusions: The niche area of Cherenkov imaging of IRMT/VMAT delivery in water tanks can allow for high resolution fast data acquisition. The agreement between Cherenkov emission and dose is very good, indicating it should be acceptable as a surrogate measure of dose under certain conditions.

EP-1517

Cervical tumour segmentation using multi-sequence MRI and linear discriminant analysis

T. Torheim[1], E. Malinen[2], U. Indahl[1], H. Lyng[3], K. Kvaal[1], C. Futsaether[1]
[1]*Norwegian University of Life Sciences (NMBU), Dept. of Mathematical Sciences and Technology, Ås, Norway*
[2]*University of Oslo, Dept. of Physics, Oslo, Norway*
[3]*Oslo University Hospital, Dept. of Radiation Biology, Oslo, Norway*

Purpose/Objective: Tumour delineation is a challenging and time-consuming part of radiotherapy planning. The task has become more complex with the increased popularity of multi-sequence and multimodal imaging. The purpose of this study was to investigate how we could combine images from different MR sequences and use them for automatic segmentation of cervical cancer tumours.
Materials and Methods: Seventy-eight patients with advanced cervical cancer where imaged using three different MRI sequences: T2-weighted MRI, T1-weighted MRI and dynamic contrast enhanced (DCE) MRI. These images were used separately or in combination as input to a Fisher's Linear Discriminant Analysis classifier. We trained the classifier to identify each voxel as either tumour or non-tumour, using the radiologist's delineations as ground truth. The segmentation results provided probability maps, giving the probability of each voxel belonging to the tumour. We used leave-one-patient-out cross-validation to assess the classifier's performance.
Results: The best segmentation model resulted in a Dice similarity coefficient of 0.37 and a Kappa value of 0.33 after cross-validation. This result is similar to the results from a previous study of agreement between radiologists. The DCE-MRI time series significantly improved tumour segmentation. The T1-weighted images gave a smaller, but also significant, increase in performance. Even though the radiologist used the T2-weighted images for delineation, these images did not improve the performance of the automatic segmentation model.
Conclusions: Our results suggest that DCE-MRI and T1-weighted MRI contain information relevant for automatic cervical tumour segmentation. The proposed method can easily be extended to include other image types, for example diffusion weighted MRI.

EP-1518

18F-NaF PET/CT-guided boost stereotactic body radiation therapy for bone metastases from prostate cancer

L. Wu[1], J. Lu[1], S. Kwee[2], M. Li[1], X. Peng[1], L. Xie[1], Z. Lin[1], Y. Kuang[3]
[1]*Cancer Hospital of Shantou University Medical College, Radiation Oncology, Shantou, China*
[2]*The Queen's Medical Center, Hamamatsu/Queen's PET Imaging Center, Honolulu, USA*
[3]*University of Nevada Las Vegas, Medical Physics, Las Vegas, USA*